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TO FILE: Goliad Exemption Statement of Basis for Decision		FROM: R6 6WQ-SG, EPA Region 6	

Brief History

The Texas Commission on Environmental Quality (TCEQ) formally submitted the program modification application in May 2011, requesting exemption of portions of the A, B, C, and D sands of the Goliad Aquifer for uranium mining. The TCEQ issued a permit for the mining operation on December 14, 2010. This permit was based in part on TCEQ's determination that the aquifer has the ability to be commercially producible and thus meets the second criterion for exemption at 40 CFR §146.4 (b) (1). The first criterion for exemption at 40 CFR 146.4(a) requires that the aquifer, or portion to be exempted must not be currently used as a source of drinking water. EPA's subsequent review of the exemption application revealed domestic drinking water wells in proximity to the proposed exemption boundaries completed in two of the sands to be exempted, raising concerns over whether the request meets EPA's current use criterion at 40 CFR 146.4 (a). These wells were completed in the shallower A (45' - 99' below ground surface (BGS)) and B (145' - 181' BGS) sands. No domestic wells were found completed in the C (212' - 269' BGS) or D (304' - 385' BGS) sands in proximity of the mining area. The domestic wells of concern lay to the SE and NW of the mining area and within, or in close proximity to, the ¼ mile area of review.

EPA staff held numerous internal discussions about the potential current use of the aquifer and developed a ground water (GW) modeling approach as a potential solution to address the criterion at 40 CFR 146.4 (a). EPA discussed this approach with TCEQ staff both in person and by telephone. On May 16, 2012, EPA formally responded to TCEQ's program modification application for an aquifer exemption, identifying the application as incomplete, stating that additional information was needed to demonstrate that the portion of the aquifer proposed for exemption was not a source for nearby drinking water wells. EPA's May 16 letter stated that the needed information "could be obtained from two-phase modeling, although TCEQ or UEC could seek to make the necessary demonstration by alternate methods." TCEQ subsequent May 24, 2012 response declined to pursue modeling or an alternate approach, stating TCEQ's interpretation that a wellbore must physically penetrate an aquifer or portion thereof before that aquifer is in current use. EPA does not agree with TCEQ's limited definition of "current use". The proposed exemption must not affect current drinking water wells. EPA asked for additional information in order to determine if the exempted area of the aquifer does not currently serve as a source of drinking water for nearby water wells.

With the TCEQ's acknowledgement, EPA initiated a direct dialogue with Uranium Energy Corporation (UEC), the applicant to the State. UEC also turned down the modeling approach to demonstrate no current use, but expressed interest in an alternative approach. Subsequent discussions with UEC resulted in additional information and a change in the requested aquifer

exemption area in order to address EPA's concerns. This change in the exemption request reflects a reduced areal extent of the original exemption request for the B, C and D sands and a substantial reduction of the areal extent of the A sand exemption being submitted by UEC to EPA for purposes of demonstrating that the domestic wells to the SE would not capture water from the portion of the aquifer within the proposed exemption using evidence of vertical isolation and GW flow gradient. The attached two maps illustrate TCEQ's initial proposed exemption area and the revised area. EPA UIC Guidance 34 states the Region should consider water supply wells within the exempted area and a minimum of a ¼ mile buffer zone from the boundary of the exempted area. TCEQ's modification of the areal extent of the original exemption effectively removed from concern some water wells as they were no longer considered in close proximity to the proposed aquifer exemption area (*i.e.*, the distance from the private wells investigated and the mining activities proposed by UEC and an updated groundwater flow direction, indicated that the movement of water from the proposed aquifer exemption area would not reach the wells of concern). This information included, among other things, groundwater elevation data sets, contour maps of these data sets indicating ground water flow direction, geologic cross-sections, water well capture zone calculations, aquifer pump test data, and related maps. This supporting documentation can be found in the administrative record, which is available for public review. In light of TCEQ's revised aquifer exemption request area and the additional information provided, the SE wells of concern are presumed to not be currently drawing water from the proposed exemption area.

Concerns Across the Area

Vertical stratigraphic isolation of the four sands planned for mining was supported by a number of cross-sections over the area showing laterally continuous clay layers separating the four sands. These cross-sections show two faults in the area. Other data submitted revealed artificial penetrations associated with exploratory drilling exist across the area and could allow fluid flow between formations if not properly plugged. Plugging records for exploratory wells drilled by a previous mineral lease holder were apparently purged from Railroad Commission files many years ago. To address this concern EPA evaluated the results of a 13 hour pump test conducted for UEC within the B sand ore body. The pump test was used, among other purposes, to detect possible communication between the A and B sands over the eastern region of the B sand ore body. The test indicated vertical isolation of the B sand in the test area. Because hydraulic isolation was demonstrated in a localized area where extensive early drilling had occurred, it is reasonable to assume exploratory wells from that earlier phase of exploration in other portions of the property were similarly plugged and would not compromise the isolation provided by the clay layers.

Concerns for wells to the SE

The effort to demonstrate hydrologic isolation for domestic wells down gradient was much more involved. UEC submitted fluid level measurements taken in the A and B sands, including at four different times within the B sand monitoring well ring, in the southern reaches of the proposed exemption. These data were used to develop contour maps reflecting the fluid pressures within the aquifer. Initial contour maps prepared by EPA staff indicated a possible flow to the

southeast. However, UEC representatives provided additional data and maintained some of the water elevation values were in error since they were substantially different than other nearby values. Subsequent EPA-prepared maps ignoring the anomalous values indicated ground water flow is quite slow in the A and B sands and is predominantly from west to east in the B sand mining area.

The local change in the regional ground water flow direction is suspected to be a result of two near parallel geologic faults, trending SW to NE in the area. Geologically, these faults form a graben (down-dropped block of strata bounded by two near-parallel faults) that appears to influence the regional ground water flow direction and decrease ground water velocity. The majority of the proposed exemption lies within this graben. Offset of formations and clay smear along the faults are believed to provide at least a partial restriction from the regional southeastern ground water flow, and likely cause the low velocity and eastward gradient observed within the mining area. The graben orientation with respect to regional ground water flow is suspected to redirect the southeastern regional ground water flow to a more west to east flow direction inside the graben.

The west to east direction of GW flow was extrapolated from the B sand ore body is to the community of Ander. Ander lies slightly more than ¼ mile to the SE of the B sand monitoring well ring and is where most of the SE domestic wells completed in the A and B sands exist. These wells lie within and just outside the ¼ mile minimum area to be considered for the exemption. Projecting the west to east ground water gradient, the water yet to be captured by the currently existing drinking water wells is expected to come from the west and not from the proposed exemption area to the northwest.

Concerns for wells to the NW

For the domestic wells to the NW, UEC submitted calculations indicating the down gradient capture zone (a geographic area of an aquifer from which a well draws water) for a well up gradient of the mining activity would not extend any further than 16 feet in the down gradient direction toward the proposed exemption area. This distance is well short of the hundreds of feet of distance between any of the domestic wells to the NW and the exemption. Although simplistic, the factors used in the calculation were conservative and the distance between the capture zone of the domestic wells so large, EPA accepted the results, finding that the domestic wells to the NW would not capture water within the exemption. Again, as with the SE wells, EPA considered the area of concern using information including the distance to private wells investigated from the proposed mining areas and ground water flow direction. This information indicated that the water wells to the NW would not draw water from the proposed aquifer exemption area. In addition, the regional background ground water gradient to the southeast contributes to hydrologic isolation of the water wells northwest of the exemption area. The finding that both the domestic wells in the NW and SE are not expected to capture water within the exempted area supports compliance with the first criterion at 40 CFR §146.4 (a).

Significance of the Faults

The two faults comprising the graben described above received considerable attention in both the TCEQ permit process and EPA's review of aquifer exemption related material. Of specific interest was the vertical and horizontal transmissivity of one or both of the faults. Since the faults penetrate the vertically isolating clay layers discussed above, hydrologic communication between sand zones along the fault plane is possible. Cross-sections constructed from penetrations in the area indicate sand to sand contacts at the fault. These may serve as avenues of hydrologic communication across the fault. In an effort to assess the fault transmissivity issues, EPA received and reviewed a short-term 4 hour pump test (a different test than the 13 hour pump test cited above) conducted near the northwest fault. During the last part of this test, small pressure drops were observed in nearby non-pumping wells completed in multiple sands. These pressure drops were attributed by UEC representatives to be a result of barometric pressure changes on the day of the test; however, EPA's assessment could not rule out the possibility that the pressure responses were possibly from the pumping well. Nevertheless, the possibility of fault transmissivity does not impact EPA's current use criterion because the capture zones of nearby drinking water wells are not interpreted to capture water from within the exemption boundaries. Despite the faults possibly being transmissive, they are interpreted to impact the ground water gradient by locally altering its direction and velocity.

In summary, the approval of the exemption is based on the hydrologic isolation of the capture zones for drinking water wells near the area the exempted area, thus meeting EPA's regulatory criteria at 40 CFR 146.4(a) that the proposed exemption does not currently serve as a source of drinking water. TCEQ is responsible for requiring adequate protection of adjacent USDWs from post-mining migration of contaminants from the exempted portion of the aquifer pursuant to 40 C.F.R. 144.146.10(a)(4).